DR-33. PRODUCTION OF THERMOSETTING POLYMERS FROM RESIDUAL GLYCEROL AND PET

A. V. Pedroso, R. T. Ferreira, G. Marciniuk, F. T. Y. Kasuga, R. B. Estevam, M. A. Voinarovicz, A. S. Ribas, L. A. Pinheiro, J. R. Garcia

Department of Chemistry of the State University of Ponta Grossa,
Av. Gal. Carlos Cavalcanti, 4748 – Uvaranas, Ponta Grossa – PR, Brazil, 84030-900

E-mail: alexvieirapedroso@gmail.com

In recent years, research for the development of alternatives to petroleum derivatives, both for energy generation and for the production of new materials has been in focus in several researches. In this sense, biofuels, especially biodiesel, have gained prominence as a viable alternative for the production of energy from a renewable source. However, following the growth in biodiesel production is the generation of the glycerol residue, which corresponds to about 10 % of the total volume of biodiesel obtained in the process. Therefore, with the growth of biodiesel production, there is inevitably a trend towards the generation of residual glycerol, which can generate major environmental disturbances. Thus, this work was based on the use of residual glycerol from the production of biodiesel in the synthesis of unsaturated polyesters, these being, thermosetting polymers widely used in the composite materials industry. In addition, recycled PET was used in the formulations in order to increase the load of raw materials from renewable sources in the production of these materials.

The methodology used was primarily based on the acetylation of pure and crude glycerol with acetic acid in order to reduce the number of free hydroxyls for esterification reaction in the synthesis of the unsaturated polyester. A mixture of mono, di and tri substituted glycerol it was obtained as the product. The acetylation product was applied in the synthesis of the unsaturated polyesters in proportions of 25 % and 50 % instead of diethyleneglycol, while recycled PET was used as a substitute for terephthalic acid. Maleic anhydride was added for generation of unsaturations in the synthesized polyesters [1].

The unsaturated polyesters synthesized with pure glycerol, crude glycerol and recycled PET were compared to the unsaturated polyester produced without glycerol. In this way, the products were characterized by FTIR, NMR, thermal analysis and mechanical evaluation. The polymers obtained were also used in the production of composites with glass fiber, in order to evaluate their industrial applicability. The functional groups and respective structures were identified by FTIR and NMR of ^{1}H and ^{13}C. The thermogravimetric analysis showed the increase in the thermal resistance of the glycerol polyesters when compared to the glycerol-free polymer, both when we used pure or residual glycerol.

The thermosetting polymers were obtained by crosslinking the unsaturated polyesters with styrene at the ratio of 55/45 (styrene/polymer). Mechanical tests of thermosetting polymers showed increased of the mechanical resistance to flexural and tension when glycerol was added to the formulation. Through the application of the unsaturated polyesters in composites with glass fiber and mechanical evaluation of the same, it was verified that the composites glycerol showed flexural and traction strength near the polymer without glycerol.

References

1. *Rastegari H.*, *Ghaziaskar H. S.*, *Yalpani M.* Valorization of Biodiesel Derived Glycerol to Acetins by Continuous Esterification in Acetic Acid: Focusing on High Selectivity to Diacetin and Triacetin with No Byproducts // Ind. Eng. Chem. Res. American Chemical Society. 2015. Vol. 54, № 13. P. 3279–3284.

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